CLAIMS

1. A data frame for use in a radio frequency communications network, the data frame including data that is coded so as to be perceived by a device receiving the data frame, as a collision when the device is already receiving data from another source.

2. A data frame according to claim 1 wherein the coded data is at the beginning of the data frame.

3. A method of detecting a collision between two transmissions in a radio frequency network of devices, the method including;

transmitting from a first device, a first data frame according to claim 1;

transmitting from a second device, a second data frame according to the data frame of claim 1; and

detecting a coded data sequence from the second data frame while receiving the first data frame, and recognising the resulting data sequence as indicating a collision.

4. A method according to claim 3 wherein upon detecting the resulting data sequence, transmitting a collision acknowledge signal to inform the first device that its transmission was interrupted.

5. A method according to claim 4 wherein the collision acknowledge signal is transmitted after all the data frames are received.

6. A method according to claim 4 wherein upon detecting the resulting data sequence, transmitting a collision signal that is itself perceived by one or more other devices as a collision.

7. A method according to claim 6 wherein the one or more other devices transmit a subsequent collision signal upon receiving the collision signal.

8. A radio communication system including at least three devices, in use,

the first device transmits a first data frame according to claim 1,

a second device transmits a second data frame according to claim 1; and

a third device receives the first and second data frames and detects the coded data from the second data frame while receiving the first data frame, and recognises the resulting data sequence as indicating a collision.

9. A system according to claim 8 wherein upon detecting the resulting sequence, the receiving device transmits a collision acknowledge after receiving the complete second data frame.

10. A system according to claim 9 wherein upon recognising the resulting data sequence, the receiver transmits a collision signal to other devices which itself will be perceived by the other devices as a collision.

11. A system according to claim 10 wherein the other devices, upon receiving the collision signal, each transmit a subsequent collision signal which is perceived by other devices as a collision.

12. A transceiver for use in a radio communication system including at least two other transceivers, in use, a first of the other transceivers transmits a first data frame according to claim 1, and the second other transceiver subsequently transmits a second data frame according to claim 1, the transceiver, in use, upon receiving the coded data from the second data frame while receiving the first data frame, recognises the resulting data sequence as indicating a collision.

13. A transceiver according to claim 12 wherein the transceiver will continue to receive the first and second data frames until the transceiver detects an end of frame marker in the data frame which finishes last, at which time, the transceiver will transmit a collision acknowledge.

14. A transceiver according to claim 13 wherein upon receiving the coded data from the second data frame, the transceiver will transmit a collision signal which will itself be perceived by the other transceivers as a collision.

15. A communications protocol for use in a radio frequency network of devices, the protocol having a frame including;

a first time slot for transmitting data;

a second time slot, after the first time slot, for transmitting a first acknowledgement state;

a third time slot, after the second time slot, for transmitting a second acknowledgement state; and

a fourth time slot, after the third time slot, for transmitting a collision indication.

16. A communications protocol according to claim 15 wherein one of the acknowledgement states is a positive acknowledge and the other acknowledgement state is a negative acknowledge,

17. A communications protocol according to claim 16 wherein the first acknowledgement state is the positive acknowledge and the second acknowledgement state is the negative acknowledge.

18. A communications protocol according to claim 15 wherein the first time slot is variable in length and the second and third time slots are fixed in length.

19. A communications protocol according to claim 18 wherein the positive acknowledge transmission includes the transmission of a specific coded value containing sufficient redundancy to allow it to be recovered in the presence of received errors.

20. A communications protocol according to claim 18 wherein the negative acknowledge transmission includes the transmission of a specific coded value containing sufficient redundancy to allow it to be recovered in the presence of received errors.

21. A radio communication system including a transceiver/transmitter, and at least two transceiver/receivers, wherein the transceiver/transmitter transmits data in a first time slot to the transceiver/receivers, and wherein upon receipt of the data, each of the transceiver/receivers return either a first acknowledgement state in a second time slot, after the first time slot, a second acknowledgement state in a third time slot, after the second time slot, or a collision acknowledgement in a fourth time slot.

22. A radio communications system according to claim 21 wherein one of the acknowledgement states is a positive acknowledge and the other acknowledgement state is a negative acknowledge.

23. A radio communications system according to claim 22 wherein the first acknowledgement state is the positive acknowledge and the second acknowledge state is the negative acknowledge.

24. A radio communications system according to claim 21 wherein the first time slot is variable in length and the second and third time slots are fixed in length.

25. A radio communications system according to claim 22 wherein upon each transceiver/receiver detecting a correctly coded transmission in the negative acknowledge time slot, each transceiver/receiver discards the data previously received in the first time slot and the transceiver/transmitter re-transmits the data to each of the transceiver/receivers.

26. A transceiver/receiver for use in a radio communications system including at least one transceiver/transmitter and at least one other transceiver/receiver, in use, the transceiver/receiver upon receiving a data packet in a first time slot from said transceiver/transmitter, either transmits a first acknowledgement state in a second time slot, after the first time slot, transmits a second acknowledgement state in a third time slot, after the second time slot, or transmits a collision acknowledgement state in a fourth time slot, after the third time slot.

27. A transceiver/receiver according to claim 26 wherein the transceiver/receiver further receives the first acknowledgement state in the second time slot from the at least one other transceiver/receiver or receives the second acknowledgement state in the third time slot from the at least one other transceiver/receiver.

28. A transceiver/receiver according to claim 27 wherein one of the acknowledgement states is a positive acknowledge and the other acknowledgement states is a negative acknowledge.

29. A transceiver/receiver according to claim 28 wherein the first acknowledgement state is the positive acknowledge and the second acknowledgement state is the negative acknowledge.

30. A transceiver/receiver according to claim 29 wherein upon receiving a negative acknowledge from the at least one other transceiver/receivers, the transceiver/receiver discards the data packet received in the first time slot.

31. A transceiver/transmitter for use in a communications system including at least one other transceiver/receiver, wherein in use, the transceiver/transmitter transmits a data packet in a first time slot to the at least one transceiver/receiver and receives either a first acknowledge state in a second time slot, after the first time slot from one or more of the transceivers/receivers, receives a second acknowledgement state in a third time slot after the second time slot from one or more of the transceiver/receivers, or receives a collision acknowledgement state in a fourth time slot after the third time slot, from one or more of the transceiver/receivers.

32. A transceiver/transmitter according to claim 31 wherein one of the acknowledgement states is a positive acknowledge and the other acknowledgement state is a negative acknowledge.

33. A transceiver/transmitter according to claim 32 wherein upon receiving a negative acknowledge, the transceiver/transmitter retransmits the data to the at least one transceiver receivers.

34. A communications protocol for use in a radio frequency network of devices, the protocol having a frame including a first time slot for transmitting data, a second time slot, after the first time slot, for indicating a repeat flag, and a third time slot, after the second time slot, for retransmitting the data transmitted in the first time slot and a fourth time slot, after the third time slot, for allowing acknowledgement of a collision between two or more transmissions.

35. A communications protocol according to claim 34 wherein the fourth time slot is divided into three sub-time slots.

36. A communications protocol according to claim 35 wherein one sub-time slot is for indicating a positive acknowledge, another sub-time slot is for indicating a negative acknowledge and the remaining sub-time slot is for indicating the detection of a collision between two or more transmissions.

37. A communications protocol according to claim 36 wherein the first sub-time slot is the positive acknowledge, the second sub-time slot is the negative acknowledge, and the third sub-time slot is the collision indicator.

38. A communications protocol according to claim 34 wherein the first and third time slots are variable in length and the first and second sub-time slots are fixed in length.

39. A communications protocol according to claim 37 wherein the positive acknowledge includes the transmission of a specific coded value containing sufficient redundancy to allow it to be recovered in the presence of received errors.

40. A communications protocol according to claim 37 wherein the negative acknowledge includes the transmission of a specific coded value containing sufficient redundancy to allow it to be recovered in the presence of received errors.

41. A communications protocol according to claim 37 wherein the collision indicator includes the transmission of a specific coded value containing sufficient redundancy to allow it to be recovered in the presence of received errors.

42. A radio communication system including a first transceiver, a second transceiver and a repeater, the first and second transceivers being separated from each other by a distance greater than at least one of their respective maximum transmission ranges, and the repeater being located intermediate the first and second transceivers, wherein upon receiving data from one of either the first or second transceivers, in a first time slot, the repeater transmits a repeater flag in a second time slot, and then in a third time slot transmits the data received in the first time slot.

43. A radio communication system according to claim 42 wherein the first and second transceivers transmit, in a fourth time slot, an acknowledgement or collision indication, indicating the successful or unsuccessful receipt of the data transmitted in the third time slot.

44. A radio communications system according to claim 43 wherein the first and second transceivers transmit a positive acknowledge in a first of three sub-time slots of the fourth time slot, or transmit a negative acknowledge in a second of three sub-time slots of the fourth time slot, or transmit a collision indication in a third of the three sub-time slots of the fourth time slot.

45. A radio communication system according to claim 44 wherein in a fifth time slot, the repeater transmits to all transceivers an overall status for the repeated transmission.

46. A repeater for use in a radio communication system including at least two transceivers, the at least two transceivers being separated from each other by a distance greater than at least one of the respective transmitting ranges, in use, the repeater being disposed intermediate the at least two transceivers wherein upon receiving data in a first time slot, the repeater transmits a repeat flag in a second time slot, transmits in a third time slot, the data received in the first

time slot, and then transmits, in a fourth time slot, a collision acknowledge, if a collision has occurred between two or more transmissions.

47. A transceiver for use in a radio communication system including at least one other transceiver and a repeater, the transceiver and the at least one other transceiver being separated from each other by a distance greater than at least one of their respective transmitting ranges, in use, the repeater being disposed intermediate the transceiver and the at least one other transceiver, wherein upon receiving a repeat flag from the repeater, in the second time slot, the transceiver suspends further action until the transceiver receives from the repeater, in a third time slot, data that was originally transmitted by the at least one other transceiver in a first time slot, before the second time slot.

48. A transceiver according to claim 47 wherein the transceiver transmits an acknowledgement indicating the successful or unsuccessful receipt of the data transmitted in the third time slot, or the occurrence of a collision occurring between two or more transmissions.

49. A transceiver according to claim 48 wherein the transceiver transmits a positive acknowledge in a first of three sub-time slots of the fourth time slot, or transmits a negative acknowledge in a second of three sub-time slots of the fourth time slot, or transmits a collision acknowledge in a third of three sub-time slots of the fourth time slot.

50. A transceiver according to claim 49 wherein in a fifth time slot, the repeater will transmit to all transceivers an overall status for the repeated transmission.

51. A radio communication system including at least a first transceiver, a second transceiver and a repeater, the first transceiver and the second transceiver being separated by a distance greater than a maximum transmission range of at least one of the transceivers, the repeater being disposed intermediate the

first and second transceivers, such that upon receipt of a data transmission from the first transceiver, the repeater re-transmits the data transmission from the first transceiver, wherein, upon receipt of a data transmission from the second transceiver before the repeater retransmits the data transmission from the first transceiver, the repeater transmits a data sequence instructing each transceiver to ignore the transmission in progress.

52. A radio communication system according to claim 51 wherein respective transmissions of the first and second transceivers are headed by a sequence coded such as to be perceived as a collision by a device receiving the transmissions overlapped in time.

53. A radio communication system according to claim 52 wherein the data sequence transmitted by the repeater begins with a sequence coded such as to be perceived as a collision when received by a receiving device.

54. A radio communication system according to claim 53 wherein upon receiving the data sequence from the repeater, each receiver will immediately transmit the same sequence coded so as to be perceived as a collision by a receiving device, once only, and then ignore further received information until the end of the transmission.

55. A radio communication system according to claim 54 wherein when the end of the transmission is reached, receiving devices will transmit an acknowledgement indicating that a collision was detected or will not transmit any acknowledgement at all.

56. A radio communication system according to claim 55 wherein upon a transmitting device finding either an acknowledgement indicating a collision, or finds no acknowledgement at all, the transmitting device will delay for a period before attempting to repeat its original transmission.

57. A radio communication system according to claim 56 wherein the delay period is calculated by each transceiver selecting a random number and scaling the random number according to the number of bits in its respective transmission.

58. A radio communication system according to claim 57 wherein if subsequent transmission retries still collide, subsequently-calculated delay periods are increased.

59. A radio communication system according to claim 58 wherein after a predetermined number of unsuccessful re-tries, the radio communication system ceases further transmission attempts.

60. A radio communication system according to claim 59 wherein after ceasing further transmission attempts, the radio communication system alerts an operator to the fact that it has ceased further transmission.